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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN AND RELATING TO TUBULAR HEAT-EXCHANGERS

(71) We, DEGGENDORFER WERFT AND EISENBAU, GES.M.B.H., a German body corporate, of 11 Werfstrasse, Deggendorf/Donau, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to heat-exchangers.

According to the present invention, there is provided a heat-exchanger for heating or cooling fluid circulated through reaction apparatus, said heat-exchanger comprising a hollow nest of tubes for the flow of a heat-exchange medium therein, a header at each end of the tubes, the header at one end of the tubes being annular and surrounding a fan impeller for circulating the fluid over the tubes in heat-exchange with said medium, and a flow deflector disposed downstream of the fan in the space within the nest of tubes and extending alongside said tubes for the major portion of their length, said flow deflector being arranged to act as an additional heat-exchange surface.

An embodiment and modifications thereof of a heat-exchanger in accordance with the invention will now be described, by way of example with reference to the accompanying diagrammatic drawing, in which:

Figure 1 is a longitudinal section of a heat-exchanger in accordance with the invention; and

Figures 2, 3, 4, 5 and 6 are each a longitudinal section of the lower part of a modification of the heat-exchanger of Figure 1.

As can be seen from Figure 1, vertical heat-exchange tubes 1 arranged in circular rows are inserted into, but can be withdrawn from, a guide tube 2 defining a flow space for a heat-carrying fluid to be circulated from reaction apparatus, for example a catalyst furnace. In the drawing only the bottom 14 of the reaction apparatus is shown. All of the tubes communicate at their upper ends with a common annular upper header 3 for a heat-exchanger medium. The cross-sectional shape of this header 3 is a matter of choice, but the inner angles 4 in particular should be well rounded, so that an inner well 5 of the header 3 may form what is regarded in flow technology as a nozzle for an impeller 6, which it closely surrounds and which serves to circulate the heat-carrying fluid. If need be, flow deflector plates 7 (only one shown) may be fitted additionally at the exit from the nozzle.

A lower header 8 of the heat-exchange tubes 1 is connected to a flow deflector 9, which substantially fills the space within the tube assembly and extends alongside the tubes of the assembly for the major portion of their length. To make the construction more rigid, the lower wall 10 of the header 8 is connected by a stay, in the form of a tube 11, to a conical deflector head 12 of the flow deflector 9. A flexible heat-exchange medium transfer pipe 13, leading into the header 3, communicates with the conical deflector head 12.

When the equipment is in use, the impeller 6 drives the stream of heat-carrying fluid past the walls 5 of the header 3, between the deflector 9 and the guide tube 2, and hence over the tubes 1, as well as through the stay tube 11, while the heat-exchange medium flows not only through the interior of the deflector 9, which is in communication with the headers 3 and 8, but also through the heat-exchange tubes 1. The manner in which the heat-carrying fluid is admitted to the impeller 6 will vary, that is centrally, eccentrically or tangentially.

In the example shown in Figure 2, the heat-exchanger, the heat-exchange tubes 1 of which communicate in this modification with an annular header 15 at their lower ends, has been fitted with a flow deflector, composed of a central cylinder 16, a dished bottom 17 and a connecting pipe 18, all serving as additional heat-exchanger surface.

In Figures 3, 4, 5 and 6 the bottom ends of the heat-exchange tubes 1 communicate

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with an annular header 19. In Figure 3, the flow deflector, consisting of a cylinder 20, a dished end 21, baffle plates 22 (required in the case of a liquid heat-exchange medium) and inlet and outlet pipe connections 23, is welded into the bottom 14 of the reaction apparatus. The inlet and outlet pipe connections 23 serve for the admission and discharge respectively of heat-exchange medium, the direction of flow of the medium being reversed at the upper end of the deflector. The heat-exchange tubes and the flow deflector 20 can thus be operated independently of each other, for example, the heat-exchange tubes 1 can contain water vapour, and the flow deflector 20 can contain a fluid comprising 27% Diphenyl and 73% Diphenyloxyd such a fluid having a boiling point of 255°C.

In Figure 4, an interchangeable flow deflector 24 is removably secured in the bottom 14 of a reaction apparatus with the aid of a flange 25 and is equipped with a burner 26. The burner 26 acts as an internal heater for the flow deflector 24 whereby to heat the flow deflector 24; the flow deflector 24 can thus serve to reheat fluid circulated through the reaction apparatus, when end othermic reactions are performed in the reaction apparatus.

In Figures 5 and 6, the heat-exchange surface area of the flow deflector is multiplied several times over by division into separate tubes with double walls which form outer tubes 27 and inner or distributor tubes 28. The outer tubes 27, in Figure 5, are welded rigidly into the bottom 14 of the reaction apparatus and are closed at their upper ends and inside them are the distributor tubes 28, open at the top, for forcing the heat-exchange medium to follow the desired path, the bottom ends of the tubes 28 opening into an inner header space or chamber 29. The annular spaces between the outer tubes 27 and the distributor tubes 28 are in communication with an outer header space or chamber 30, this outer chamber being fixed to the bottom 14 of the container in such a way that the parts referred to can be removed without interfering with the running of the installation.

In Figure 6, the flow deflector consists of individual tubes 31 and a central flow main tube 32 both welded rigidly to the bottom 14 of the reaction apparatus and fitted with replaceable electric heating elements 33 which serve a similar purpose to that of the burner 26, in Figure 4. This arrangement makes the differential application of heat possible between tubes 31 and tube 32 and easy to control in accordance with the technique of regulation.

Apart from the hereinbefore mentioned advantages arising with a heat-exchanger constructed in accordance with the invention for the operation of another piece of equipment into which it is incorporated, such as a catalyst furnace, for example, it should also be emphasised that the range of use of the latter is made far more extensive and that relatively less idle time and loss of production arises, because, should faults develop in other parts of the installation, the time-consuming cooling and heating-up of the catalyst furnace, which otherwise takes about 65 to 75 hours, is eliminated.

WHAT WE CLAIM IS:—

1. A heat-exchanger for heating or cooling fluid circulated through reaction apparatus, said heat-exchanger comprising a hollow nest of tubes for the flow of a heat-exchange medium therein, a header at each end of the tubes, the header at one end of the tubes being annular and surrounding a fan impeller for circulating the fluid over the tubes in heat-exchange with said medium, and a flow deflector disposed downstream of the fan in the space within the nest of tubes and extending alongside said tubes for the major portion of their length, said flow deflector being arranged to act as an additional heat-exchange surface.

2. A heat-exchanger according to claim 1, wherein the flow deflector includes a hollow member through which a heat-exchange medium can flow or which has internal heating means.

3. A heat-exchanger according to claim 2, wherein the ends of the flow deflector communicate with the same headers as the tubes and form a unit with the latter.

4. A heat-exchanger according to claim 2, wherein the flow deflector is removably mounted.

5. A heat-exchanger according to claim 4, wherein the flow deflector has at one end connections for the admission and discharge of the heat-exchange medium, the direction of flow of which is reversed at the other end of the deflector.

6. A heat-exchanger according to claim 5, in which the flow deflector comprises a number of tubes with double walls, forming outer tubes and inner tubes, the lower ends of said outer and inner tubes communicate with respective headers, while the inner tubes open at the upper ends into the outer tubes, which at that end are closed.

7. A heat-exchanger according to any one

of the preceding claims, comprising means for feeding the fluid either concentrically, eccentrically or tangentially to the impeller.

8. A heat-exchanger substantially as hereinbefore described with reference to Figure 1 or to Figure 1 as modified by any one of Figures 2 to 6.

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1247177 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig.1

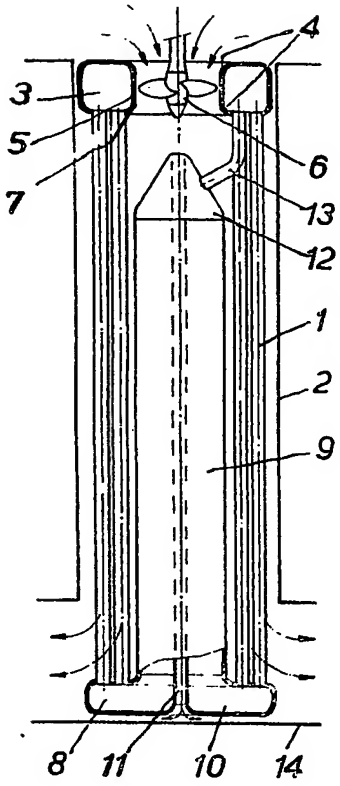

Fig.3

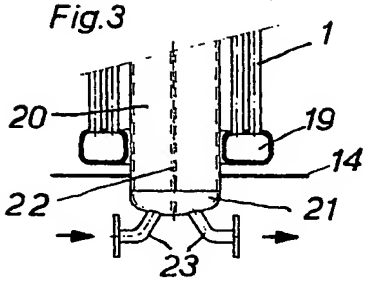

Fig.4

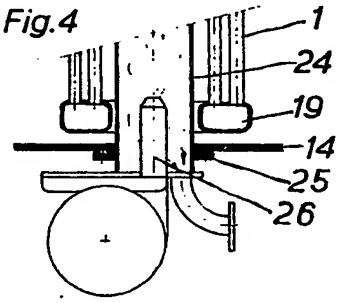

Fig.5

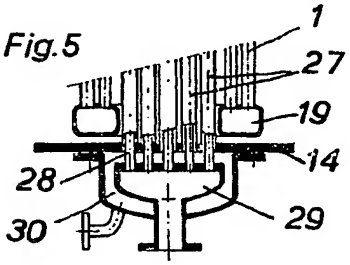

Fig. 2

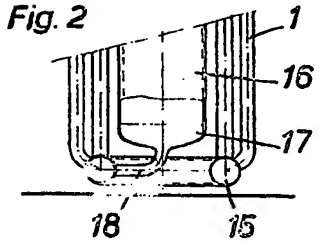

Fig.6